ROBERTSHAW CONTROLS COMPANY
NEW STANTON DIVISION
NEW STANTON, PENNSYLVANIA

GAI CONSULTANTS, INC.
Pittsburgh-Monroeville
Pennsylvania 15146

GROUNDWATER INVESTIGATION
INACTIVE PLANT DISCHARGE POND

PROJECT 79-204
MARCH 1980

ORIGINAL
(Red)

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INACTIVE PLANT DISCHARGE POND

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570 BEATTY ROAD
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ORIGINAL (Red)

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ORIGINAL
(Red)

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INTRODUCTION

The Robertshaw Controls, New Stanton Division plant located near Youngwood, Pennsylvania, is a manufacturer of thermostatic control devices. Figure 1 locates the plant relative to the general area. The production sequence produces wastewater which contains elevated levels of mercury. At present this mercury is removed from the wastewater prior to discharge to an unnamed stream located northeast of the plant. Previously, mercury removal was not practiced, and the discharge was routed through a small pond located at the plant. This produced a high mercury concentration within the pond and its sediments. The waste discharge to the pond was discontinued. Approximately one year later the mercury in the pond water was adsorbed onto powdered activated carbon (pac) and allowed to settle into the sediments. This procedure succeeded in substantially lowering the level of mercury in the pond, concentrating the mercury in the pond sediments. A mitigating factor reducing the possibility of mercury migration through the sediments into the local groundwater system is the presence of a bentonite liner beneath the pond. However, the absence of records concerning the extent and thickness of the bentonite layer and method of construction preclude conclusions as to the possible integrity of the bentonite liner.

Concern expressed by the Pennsylvania Department of Environmental Resources (DER) over the potential mercury contamination of local groundwater has prompted the present investigation. The purpose of this study is twofold, one to establish the hydraulic impact of the pond on the groundwater system and, second to assess to what degree, if any, mercury may have reached the groundwater. To accomplish these objectives a number of tasks were initiated including:

- The establishment of a monitoring well program consisting of eight wells located strategically around the periphery of the pond (Figure 2). Five of the wells were extended to a depth sufficient to insure intersection with rock strata dipping beneath the pond. The remaining three wells were located to intercept and monitor any near surface downslope flow through either fill placed during site grading and/or unexcavated weathered shale.
- The collection of updip and downdip ground and surface water samples to assess the extent of mercury seepage from the pond. Groundwater samples were secured from the wells located near the pond while surface water samples were taken at greater distances downdip from streams intercepting rock strata exposed beneath the pond.
- The selective sampling of soil and rock specimens for evidence of adsorbed mercury to document the direction and depth of any previous pond discharge(s) to the groundwater. Samples were selected from rock cores and spoon samples taken at the site of the eight monitoring wells with subsequent analysis for mercury. Rock specimens for analysis were chipped from fractured and bedding surfaces.

The results of this study authorized by Robertshaw Controls are presented in the following sections.

GEOLOGIC SETTING

The Robertshaw Controls Youngwood Plant is underlain by the Morgantown sandstone member of the Conemaugh Formation. In the area of study, the Morgantown is characterized by interbedded sandy and silty shales which are reported to dip north-northwest at approximately two degrees towards the Greensburg syncline which plunges gradually north-northeastward (Figure 1).[1*] Boring logs taken during the coring and installation of the monitoring wells and presented in Appendix A, indicate a sequence of near surface silty shales underlain progressively at depth by fissile clay shales with very thin calcareous seams and limy claystone with calcium carbonate inclusions. Calculation of the strike and dip of these rock strata based on the elevation of the claystone contact indicates that locally these rock units are dipping N 15° E at approximately 2.2 degrees.

Figure 3 presents stratagraphic cross-sections drawn across the pond oriented along the strike and dip of the rock units. Cross-Section A-A' drawn down the dip of the inferred rock strata illustrates the potential for seepage to occur northeastwards down the dip of permeable rock strata. Previous boring logs prepared by Pennsylvania Drilling Company (9-16-58) describe a weathered rock mantle of from 8 to 14 feet thick on the preexcavation surface of this site. This unconsolidated mantle grades downwards from a highly weathered clayey silt surface soil to increasingly less weathered, yet highly fractured shale. High permeabilities and potential for subsurface seepage exists within the highly fractured shale which rests between impervious surface soil and intact bedrock. Remnants of this original

*See list of references

weathered mantle remain along the eastern end of the pond as described in Boring Logs 5 and 6. Since the preexcavation surface originally sloped towards the east-northeast (Figure 2), it can be anticipated that the weathered mantle which formed parallel to that surface, likewise dips in that direction beneath the existing graded surface (Figure 3). Thus, any seepage occurring along the eastern edge of the pond would tend to flow readily downslope along the fractured shale zone as indicated in cross-section B-B' on Figure 3.

GROUNDWATER FLOW CONDITIONS

Following a preliminary reconnaissance of the pond and its environs, eight points were selected for soil and rock sampling and subsequent well installation (Figure 2). Five deep well sites intended to intersect rock strata dipping beneath the pond were placed around the periphery of the pond and located to avoid interference from buried utility lines. Three additional shallow well sites were placed down gradient of the pond with respect to the existing and preexcavation surfaces to monitor near surface and perched waters.

Continuous samples of the unconsolidated surficial materials were obtained by repeatedly driving a split-barrel sampler from the surface until refusal with coherent rock. An NX core barrel was then used to secure a continuous rock core to the designated well depth. Upon completion of sampling, the hole was reamed with a six inch roller cone to facilitate installation of the 4-inch monitoring well. Installation of the deep wells was designed to restrict recharge to the intact rock strata avoiding recharge from any surficially fractured rock or soil zone. Shallow wells were installed to accept near surface or perched water while preventing direct surface seepage. Details of the installation sequence for the individual well is given with the respective boring logs in Appendix A. Following installation, the wells were pumped out and allowed to recharge naturally. Recharge in all wells was fairly rapid, with complete recharge occurring within two hours of evacuation in most instances. Prior to monitoring the elevation of the wells was surveyed (Figure 2) using the ground floor elevation of the office building established on the Rust Engineering Grading Plans (April 28, 1966).

Table 1 summarizes the groundwater measurements made one week after installation of the wells and rechecked several weeks later. Though no substantial differences in groundwater elevations were observed over this brief period of time, it must be emphasized that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time measurements were made and reported herein. This data was used to construct groundwater flow nets (Figure 4) with interpolation of equipotential and orthogonal flowlines from elevations of the groundwater surface observed in the individual wells.[2] Generalized groundwater flow in the vicinity of the pond for both shallow and deep well data is directed towards the east-northeast, approximating the original, preexcavation, downslope direction. A groundwater high recorded around well No. 2 and its likely downslope intersection with the present surface explains the saturated ground conditions noted in the field along the north end of the pond. Similarity between the flow nets constructed for the deep and shallow wells (Figures 4a and 4b) indicates the apparent absence of confined or perched waters at the site. This condition is not surprising considering the degree of fracturing observed in the underlying rock strata.

More detailed interpretations of the groundwater flow path around the pond can be made based on assumptions of the extent to which continuity exists between water in the pond and the surrounding groundwaters. If complete isolation of the pond water were achieved, flowlines impinging on the pond liner system would be diverted around the pond as depicted in Figure 4c. If, on the other hand, there existed complete hydraulic continuity between the groundwater and water in the pond, then groundwater recharge of the pond would be expected along the western portion of the pond where groundwater elevations rise above the surface elevation of the pond. Concurrently discharge would occur along the eastern margin towards lower groundwater elevations on the downslope side of the pond as presented in Figure 4d. Noticeably, groundwater depths on the downslope discharge end of the pond tend to rise upwards towards the pond, intersecting with the surface elevation of the pond (Figure 3). This seems to suggest a degree of hydraulic continuity between these waters. If so two situations could exist. Either the structural integrity of the pond liner has been interrupted allowing direct flow through the pond liner or other groundwater conditions may exist. These include imperceptible fluctuations of the groundwater level which permit sufficient time for the pond waters to equilibrate with surrounding groundwater conditions, or the meer chance occurrence of equivalent groundwater levels. Verification of the degree of continunity could be obtained through an extended well monitoring program where fluctuations in the groundwater level are compared with fluctuations and response of water within the pond.

WATER QUALITY

Table 2 summarizes the concentrations of mercury found in groundwater, surface water, and soil-rock samples (Appendix B). The concentration of mercury in the ground and surface waters, analyzed in this study, are within the acceptable (2 ppb) EPA tolerance level for primary drinking water.[3] In most instances the concentration of mercury is below the analytical detection limit of 0.5 ppb established for the cold vapor analysis. Groundwater samples were obtained for analysis after pumping of the individual wells produced a clear solution. Only in shallow well No. 5 was a clear water sample not obtained.

Surface water samples as shown in Figure 1 were obtained along two parallel northwest to southeast flowing streams which dissect down-dip rock strata exposed under the pond. The intent of these samples was to assess the impact, if any, of the potential downdip groundwater migration plume outlined in Figure 1. Samples S-2 and S-5 provide background water quality, upstream of anticipated bedrock seeps, whereas samples S-3, S-4, S-6, and S-7 provide downdip water quality. Of the downstream samples only Sample S-4, sampled approximately one mile downstream of the Robertshaw Controls Plant, showed any detectable indication of the presence of mercury. Barring analytical error, it is postulated that this downstream rise in mercury could result from either an earlier mercury discharge(s) now absorbed on sediments in the stream or from farming and trucking operations within the watershed. One other consideration is the near approach and overpassing of the stream by the Pennsylvania Turnpike near the sampling point. Sample S-3 obtained further upstream and within one-quarter mile of the present plant discharge point, detected no measurable mercury.

The location, depth of sampling and origin of the respective rock-soil samples is summarized in Table 3. Control Sample RX-16 from an unaltered silty shale fracture stratigraphically above the elevation of the pond, as well as representative samples from the clay shale (RX-8) and limy claystone (RX-15) contained 1 ppm or less of Mercury (Table 2). Allowing for a normal degree of testing and sampling variance, (e.g., failure to obtain a good surface specimen from the rock chip), 4 of the 16 samples submitted for analysis appear to contain abnormally high mercury contents, higher even than that adsorbed within the bentonite liner. Three of these aberant results were taken at varying depths in bore hole No. 6 while the fourth was from a near surface fracture in adjacent Bore Hole No. 8. Both sampling points are located on the eastern discharge end of the pond (Figure 4d) documenting prior continuity between the pond and the groundwater with a downslope component of flow in the direction of the preexcavation surface. If mercury were continuing to seep beyond these two bore points, it would be expected to show up in water samples (S-3 and S-4) taken in the nearby stream. Absence of substantive levels of mercury in these samples indicates that either the seepage front has passed since discontinuance of pond discharge or mercury has been adsorbed in passage through the rock strata.

CONCLUSIONS

The groundwater surface in the vicinity of the Robertshaw Plant conforms to the general surface topography. Groundwater flow potential determined from well data indicates flowlines crossing the pond site from west to east, paralleling the downslope gradient of the preexcavation surface. Correspondence between groundwater elevations and the pond surface elevation, and evidence of previous mercury migration on rock surfaces along the downslope side of the pond, suggests probable hydraulic continuity between the pond and the surrounding groundwater. It is reasoned that former discharges of mercury from the pond into the surrounding rock strata would have been preferentially channeled downslope along the highly pervious fractured shales existing near the surface along the eastern end of the pond. From this zone of rapid seepage which parallels the preexcavation surface, discharge from the pond would penetrate to greater depths along occasional angular fracture planes in the underlying bedrock. No evidence was found, however, to substantiate the present downdip seepage of mercury along the hypothetical subsurface migration plume. Analysis of groundwater within the environs of the pond obtained from well samples and surface waters at greater distance down gradient, indicates no apparent present detrimental impact from previous mercury discharge(s) into the pond.

RECOMMENDATIONS

The presence of adsorbed mercury on the clay mineral surfaces of the ponds bentonite liner and on rock fracture surfaces along the eastern discharge end of the pond provides the possibility of future desorption of mercury and possible groundwater contamination. Desorption of mercury from its presently held positions on mineral surfaces would require a change in the surrounding chemical environment. Changes which could induce desorption of mercury include natural or artificial alterations in the chemistry of the ponds water or long-term (greater than one year) weathering alterations along the present surface. Thus, continued well monitoring and sampling on a quarter year basis is recommended as a precautionary measure. The compilation of a continuous record of water quality around the pond could also prove beneficial in differentiating outside, extraneous inputs of heavy metals elsewhere in the surrounding watershed.

Respectfully submitted,
GAI Consultants, Inc.

not responsive based on revised scope

[redacted]

LIST OF REFERENCES

1. Department of the Interior, U.S.G.S., "Brownsville - Connellsville Pennsylvania Folio," #94, Washington D. C., 1903.

2. Davis, S. N., and DeWiest, R. J. M., Hydrogeology, John Wiley and Sons, Inc., New York, New York, 1966.

3. EPA, "National Interior Primary Drinking Water Regulations," Federal Register, Volume 40, #248, Washington, D. C., 1975.

Table 1

WELL MONITORING DATA
(11/28/79)

Well No.*	Pumping Time Start	Pumping Time Finish	Total Minutes	pH	Temp. °C	Depth from Ground Surface Start	Depth from Ground Surface Finish	G. W. Elevation (ft above sea level) (11/28/79)	G. W. Elevation (ft above sea level) (12/14/79
1	12:31	12:40	9	7	8	3.75	4.25	1032.52	1032.46
2	11:40	11:48	8	7	9	1.67	2.50	1034.79	1034.76
3	11:25	11:35	10	7	8.5	0.67	2.50	1031.72	1031.75
4	10:13	10:21	8	7	9.5	3.90	5.0	1029.28	1029.40
5	10:53	11:17	24	7	10	5.00	5.83	1030.25	1030.25
6	10:37	10:45	8	7	8	6.00	7.0	1029.43	1029.69
7	12:07	12:15	8	7	8	2.72	2.75	1031.67	1031.25
8	11:56	12:01	5	7	7.5	5.08	5.50	1031.55	1031.55

*See Figure 2 for well location and depth. Well numbers correspond to boring numbers.

ORIGINAL (Red)

Table 2

CONCENTRATIONS OF MERCURY IN GROUND AND SURFACE WATER SAMPLES AND IN ROCK-SOIL SAMPLES

	Groundwater Samples								Surface Water Samples						
	Monitoring Well								Pond	Stream 1+			Stream 2		
	1	2	3	4	5	6	7	8	S-1	S-2	S-3	S-4	S-5	S-6	S-7
Hg conc. (ppb*)	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	1.0	<.5	<.5	1.1	<.5	<.5	<.5

ROCK-SOIL SAMPLES

	B.P. 1++				B.P. 2		B.P. 4		B.P. 6				B.P. 8				Bentonite Liner
	RX-1	RX-2	RX-3	RX-4	RX-5	RX-6	RX-7	RX-8	RX-9	RX-10	RX-11	RX-12	RX-13	RX-14	RX-15	RX-16	S-8
Hg conc. (ppm**)	2.0	<1.0	3.0	3.0	3.0	<1.0	3.0	1.0	6.0	11.0	<1.0	12.0	11.0	<1.0	<1.0	<1.0	2.2

*Parts per billion. Limit of detection 0.5 ppb.
**Parts per million. Limit of detection 1.0 ppm.
+See Figure 1 for stream location.
++Bore point numbers correspond to well numbers.

ORIGINAL (Red)

Table 3

DESCRIPTION OF LOCATION AND FEATURE SAMPLED FOR ROCK-SOIL SAMPLES

Sample No.	Bore Number	Depth	Sampled Feature
RX-1	B.P. - 1*	5.0'	Very broken iron stained shale - bedding plane
RX-2	B.P. - 1	11.0'	Calcareous rock flour along fracture plane
RX-3	B.P. - 1	15.0'	Chips from highly fractured shale - claystone contact zone
RX-4	B.P. - 1	20.0'	Slickenside surface in claystone
RX-5	B.P. - 2	15.0'	Bedding fracture with seam of carbonates
RX-6	B.P. - 2	17.5'	Fractured surface (30°) with carbonate coating
RX-7	B.P. - 4	9.0'	Fractured surface (60°) with iron staining
RX-8	B.P. - 4	17.5'	Fractured iron stained surfaces
RX-9	B.P. - 6	4.0'	Highly weathered shale residuum
RX-10	B.P. - 6	9.0'	Fragmented iron stained shale zone

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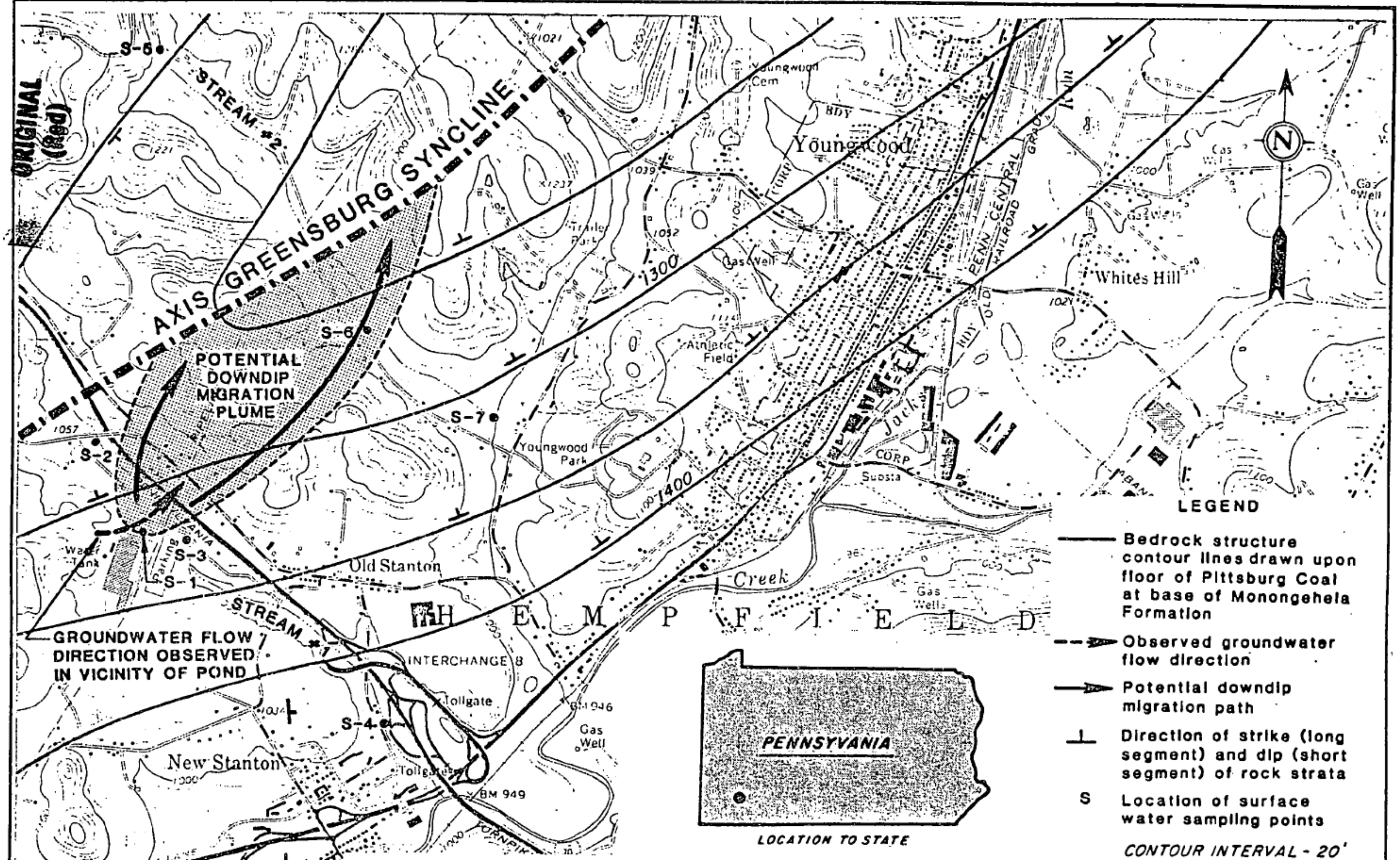
Table 3
(Continued)

Sample No.	Bore Location	Sampling Depth	Sampled Feature
RX-11	B.P. - 6	13.0'	Very broken iron stained shale - bedding surface
RX-12	B.P. - 6	20.5'	Slickenside surface in claystone
RX-13	B.P. - 8	2.0'	Fractured surface (60°) with iron staining
RX-14	B.P. - 8	16.5'	Very broken claystone fragment
RX-15	B.P. - 8	20.5'	Slickenside surface in claystone
RX-16	B.P. - 2	2.5'	Unaltered silty-shale surface

*Bore point or well number.



SCALE:

1000 0 1000 2000

(FEET)

REFERENCE DRAWING: TOPOGRAPHIC MAP, 7.5 MINUTE SERIES, MOUNT PLEASANT QUADRANGLE, PA. DATE 1964

gai CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists
570 Beatty Rd. • Pittsburgh, Monroeville, Pa. 15146
412-242-6530

Location of the Robertshaw Controls, New Stanton Plant, Local Structural Geology and Observed and Potential Groundwater Flow Paths

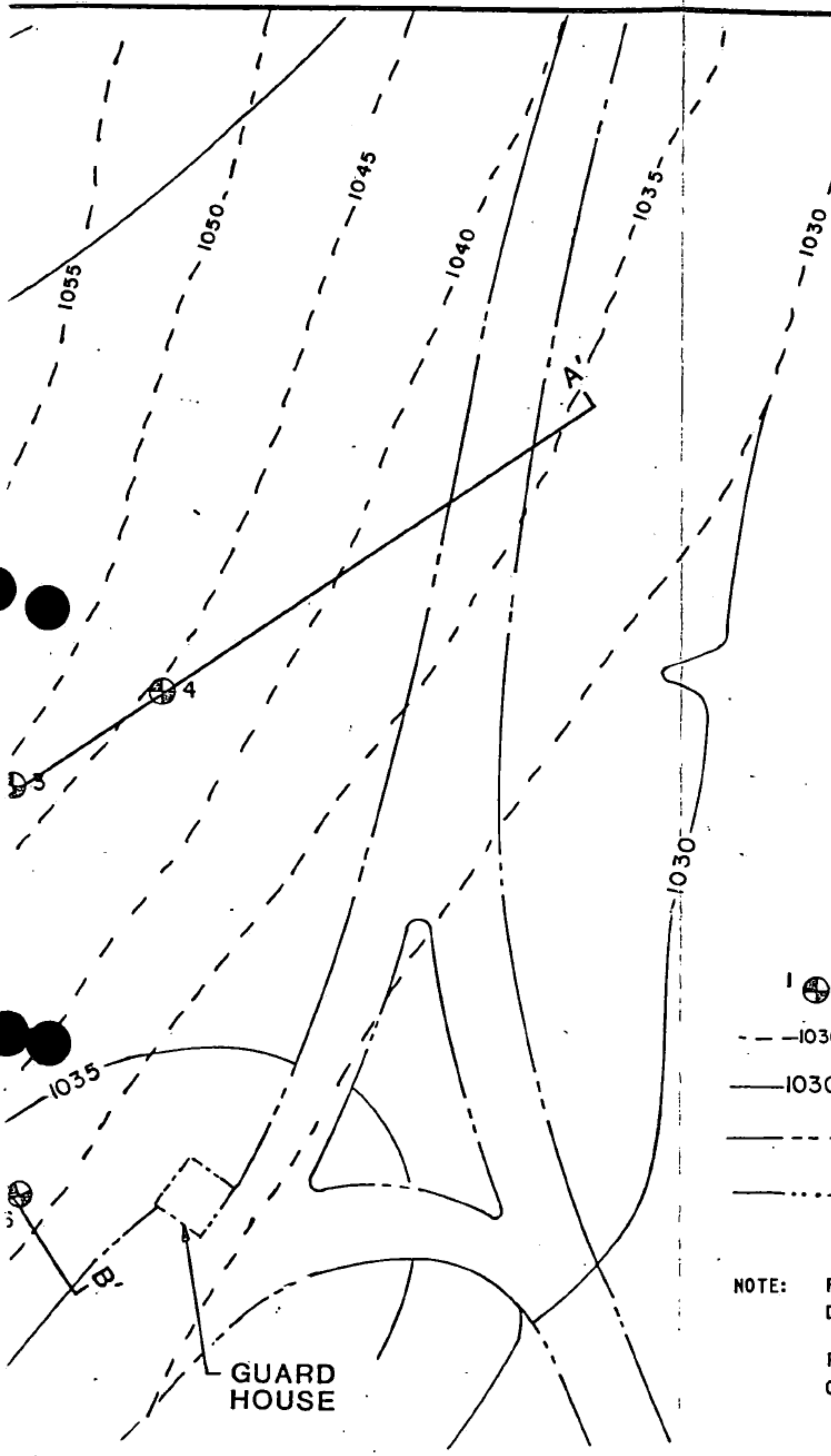
ROBERTSHAW CONTROLS COMPANY
NEW STANTON DIVISION
NEW STANTON, PENNSYLVANIA

DWN. [redacted] CHKD.
APPD. DATE
SCALE: AS SHOWN
DRAWING NUMBER
79-204-A1
REV

Figure 1

19 1253 HERCULENE A. & B. SMITH CO., PGH., PA. PR 9307—1074

ORIGINAL
(Red)



SCHEDULE OF BORINGS		
BORING NUMBER	GROUND SURFACE ELEVATION (11/22/79)	DEPTH (FT.)
1	1036.2	21.2
2	1036.4	20.8
3	1032.4	7.8
4	1033.2	21.0
5	1035.3	7.5
6	1035.4	21.0
7	1034.4	7.4
8	1036.6	21.0
TOTAL FOOTAGE		127.7

LEGEND

1 ⊕ MONITORING WELL LOCATION

- - —1030— ORIGINAL GROUND SURFACE CONTOURS

——1030 — EXISTING GROUND SURFACE CONTOURS

—— - - —— EXISTING FEATURES

——- · · · —— EDGE OF POND

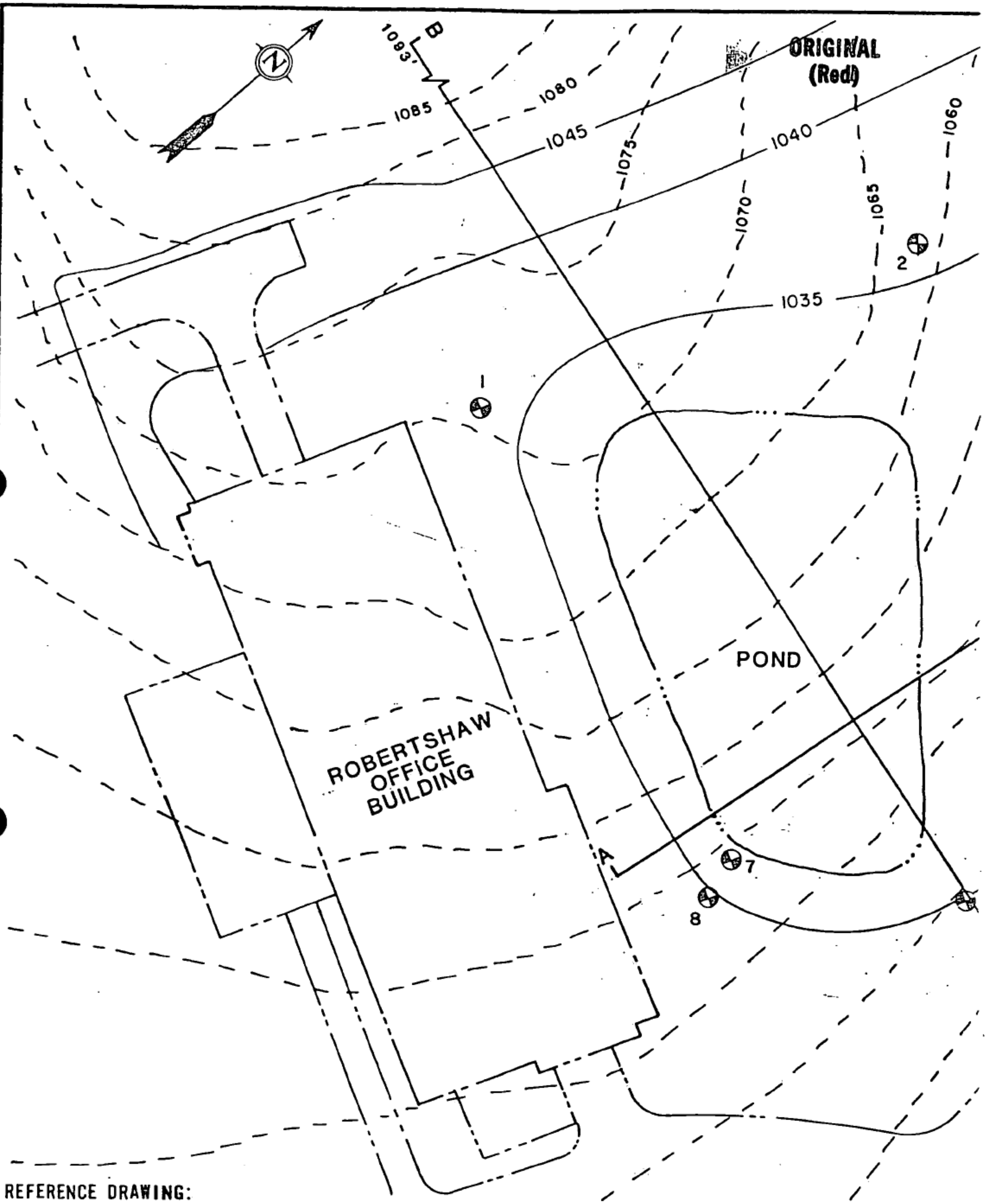
NOTE: FOR SECTIONS A-A' AND B-B' SEE DRAWING 79-204-B2.

POND ELEVATION AT 1032.1 FEET AMSL ON 11-28-79.

Figure 2

GAI CONSULTANTS, INC. Engineers • Geologists • Planners Environmental Specialists 570 Beatty Rd. • Pittsburgh, Monroeville, Pa. 15146 412-342-8530	MONITORING WELL LOCATION MAP	DWN. [redacted] CHKD.
		APPD. DATE
	ROBERTSHAW CONTROLS COMPANY NEW STANTON DIVISION NEW STANTON, PENNSYLVANIA	SCALE: 1" = 200'
		DRAWING NUMBER 79-204-B1 REV

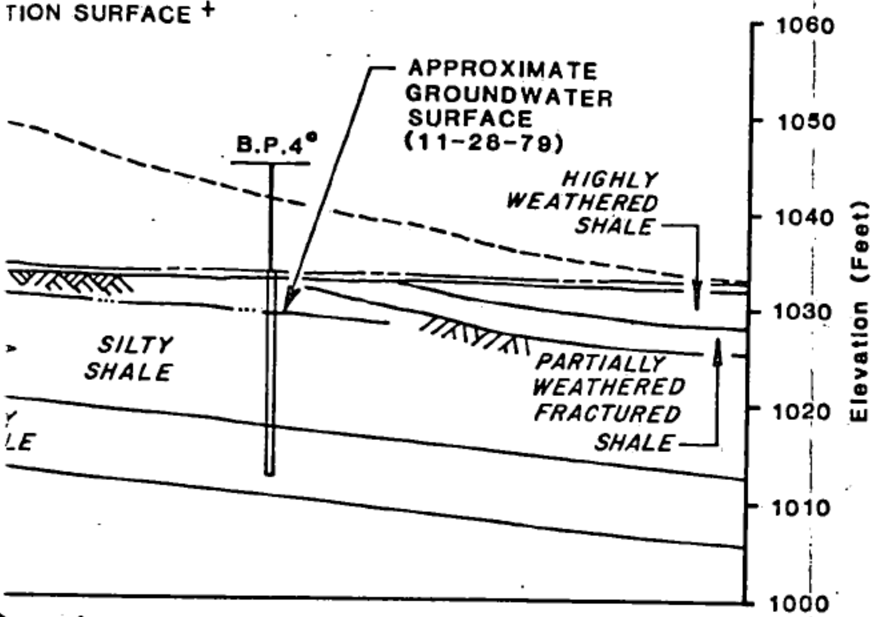
PW 1265-1277



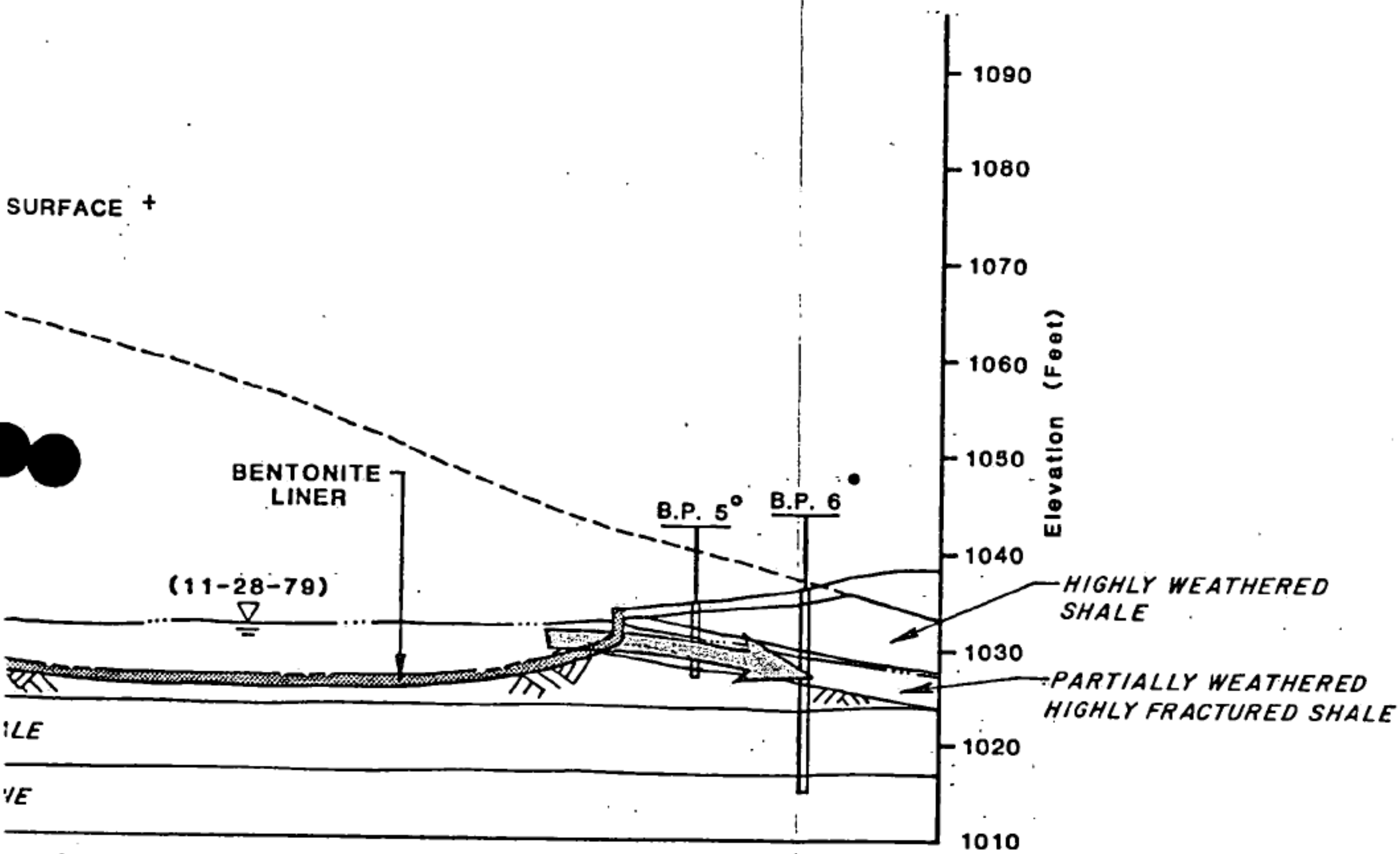
REFERENCE DRAWING:

A PHOTOGRAPHIC REPRODUCTION OF THE RUST ENGINEERING CO. DWG. NO. 8033-A4 - GRADING PLAN.ROBERTSHAW-FULTON CONTROLS CO. NEW STANTON,PA. REVISION 10 DATE 4-28-66.

ORIGINAL
(Red)



A-A'
o ock Strata *

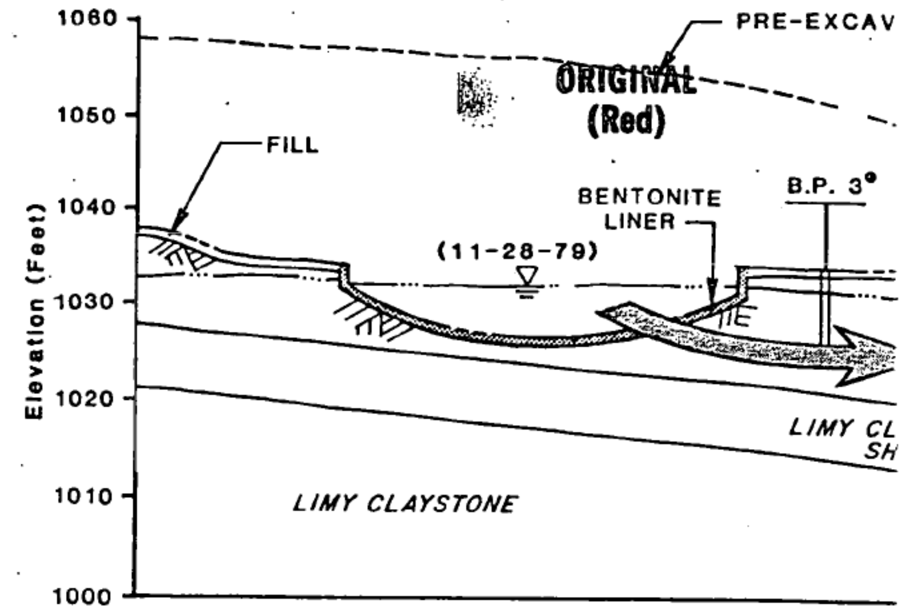


-B'
f Rock Strata *

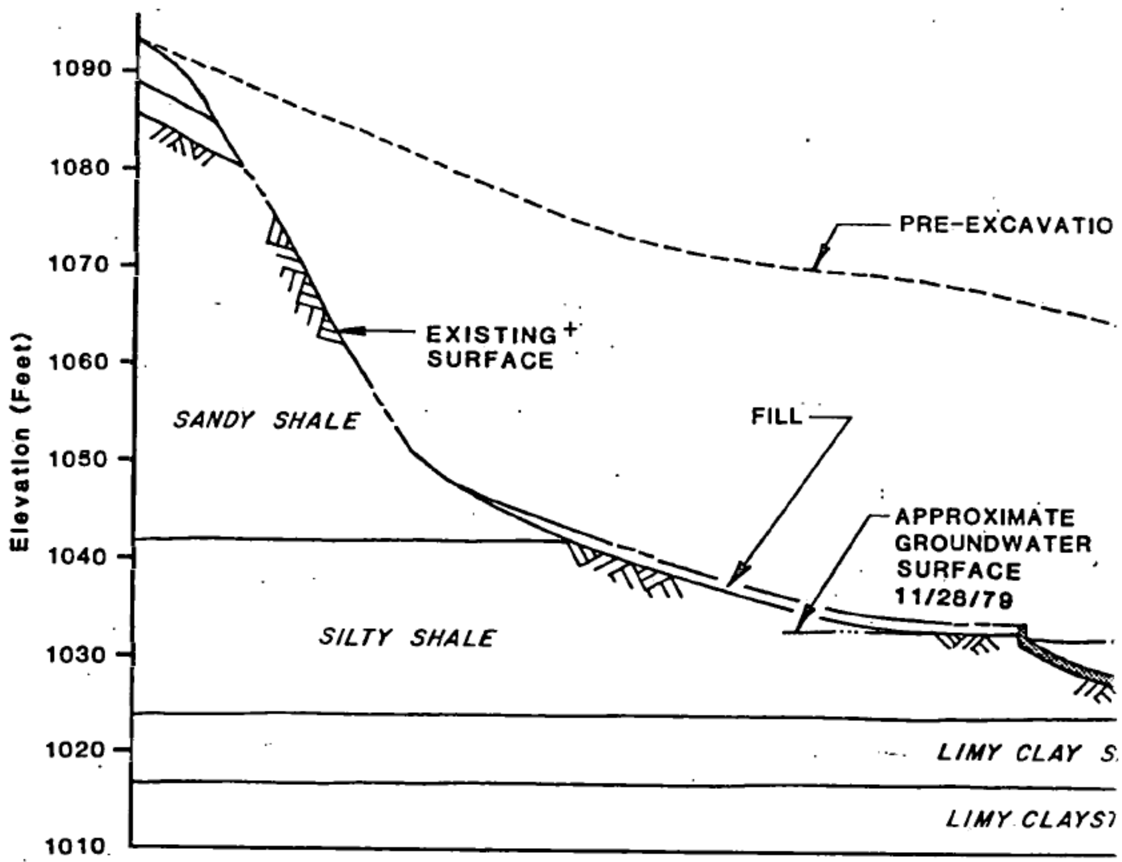
Figure 3

gai CONSULTANTS, INC. Engineers • Geologists • Planners Environmental Specialists 570 Beatty Rd. • Pittsburgh, Monroeville, Pa. 15146 412-242-6530	CROSS SECTIONS ORIENTED WITH THE STRIKE AND DIP OF THE UNDERLYING ROCK STRATA	DWN. [redacted] not responsive base CHKD.
		APPD. DATE
	ROBERTSHAW CONTROLS COMPANY NEW STANTON DIVISION NEW STANTON, PENNSYLVANIA	SCALE: AS SHOWN
		DRAWING NUMBER 79-204-B2 REV

PW 1265-1277



Section
Drawn with Di



Section
Drawn with Dip

NOTES:

* FOR TRANSECT LOCATION SEE DRAWING 79-204-BI.

\+ SURFACES BASED ON RUST ENGINEERING DRAWING (4/28/66)

SCALE: 1" = 50' HORIZONTAL
1" = 20' VERTICAL

LEGEND

UNWEATHERED BEDROCK SURFACE

POTENTIAL SEEP DIRECTION

• BORE POINT AND MONITORING WELL LOCATION

ORIGINAL (Red)

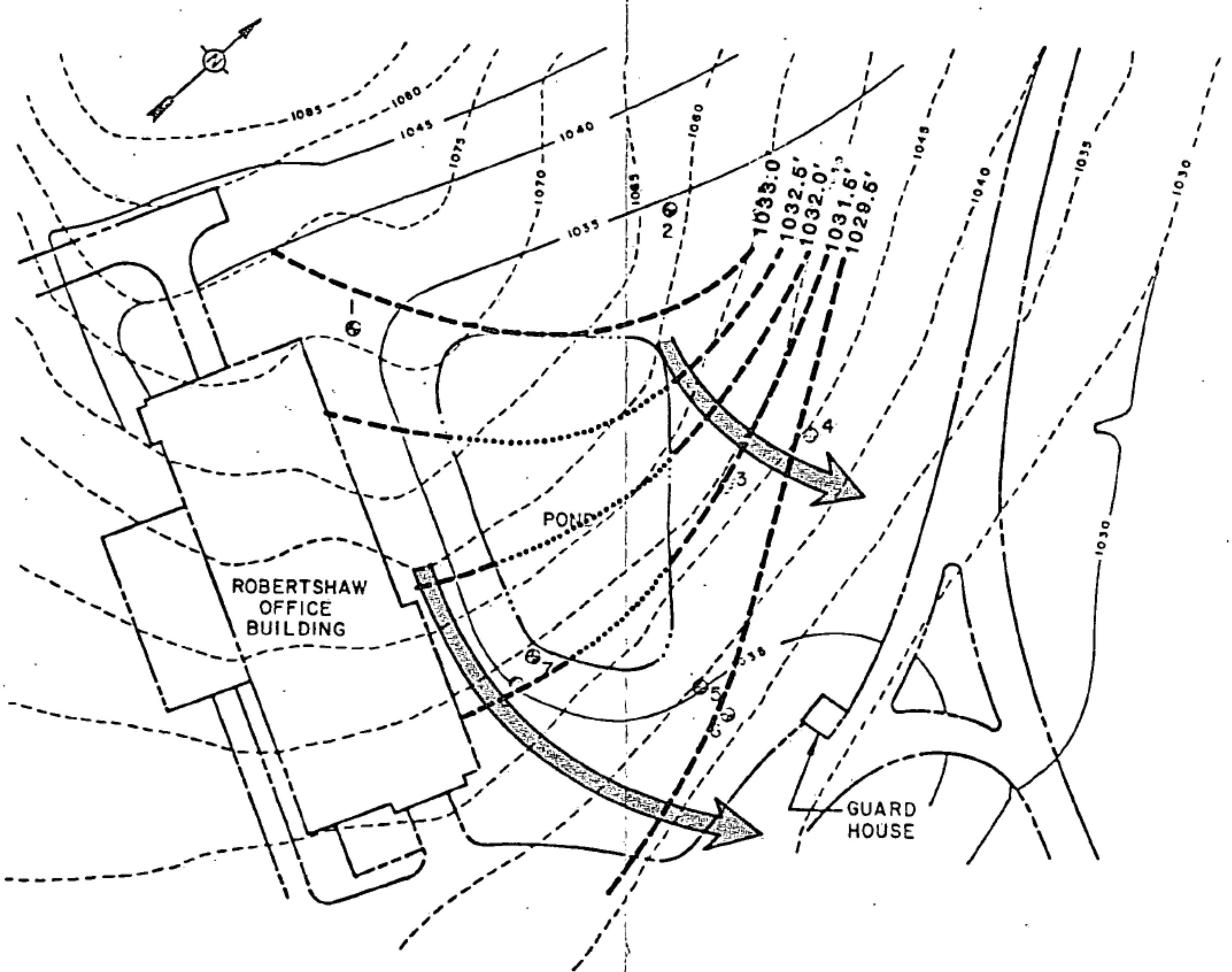


Figure 4b – Deep Well

NOTE: * REFERENCE DRAWING 79-204-B11

Figures 4a and 4b

gai CONSULTANTS, INC. Engineers • Geologists • Planners Environmental Specialists 570 Beatty Rd. • Pittsburgh, Monroeville, Pa. 15146 412-242-6530	GENERALIZED GROUNDWATER FLOW DIRECTION	DWN. [redacted]	CHKD.
		APPD.	DATE
	ROBERTSHAW CONTROLS COMPANY NEW STANTON DIVISION NEW STANTON, PENNSYLVANIA	SCALE: 1" = 400'	
		DRAWING NUMBER 79-204-B3	REV

PW 1265–1277

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(Red)

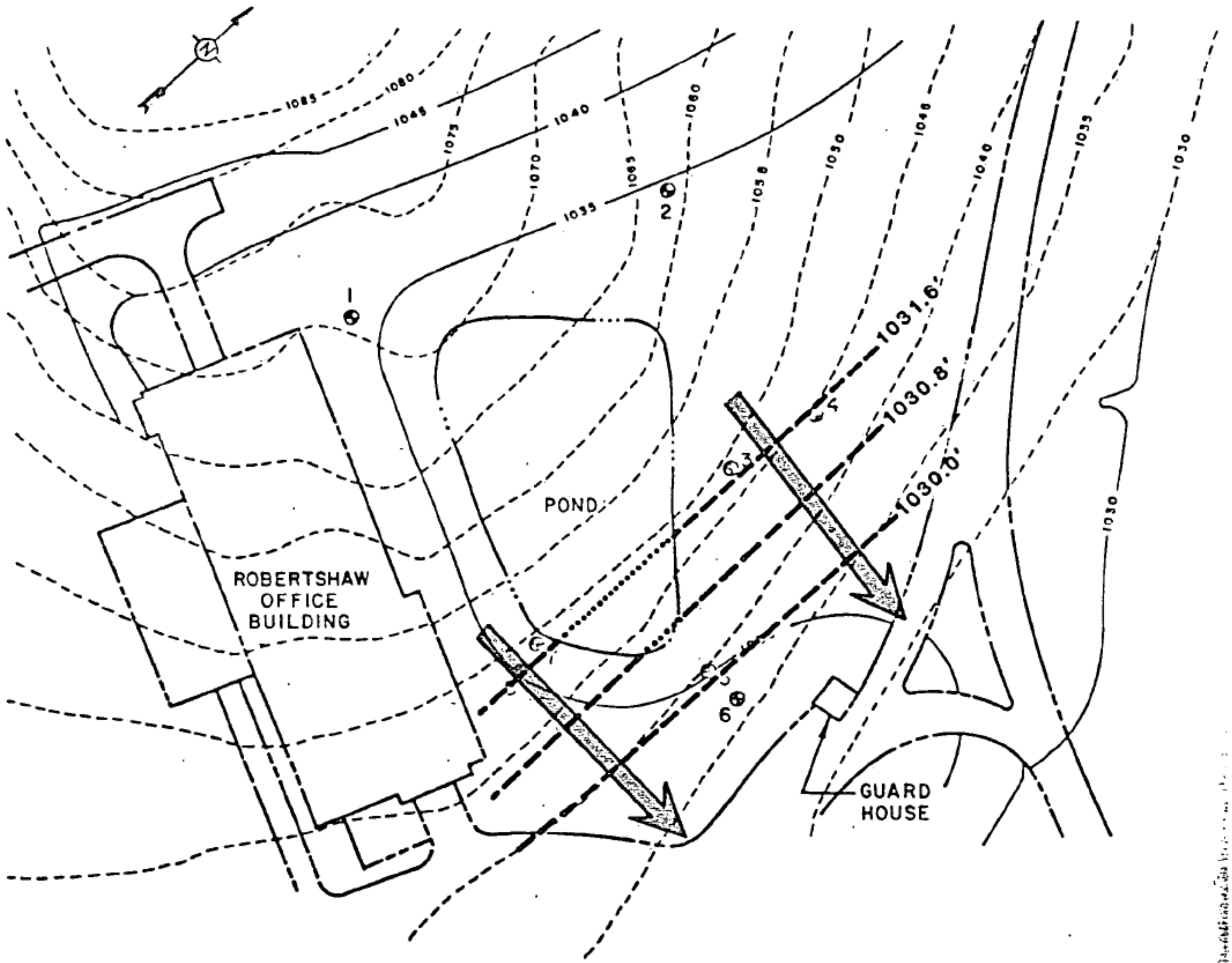
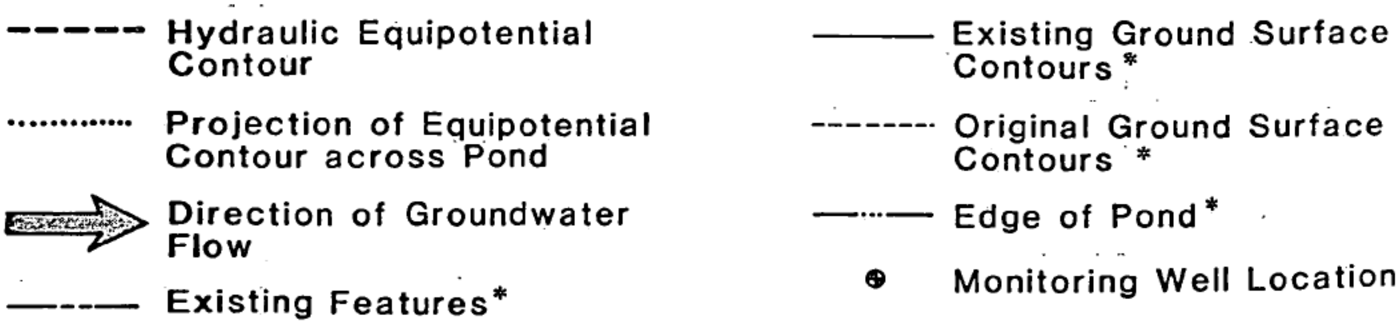


Figure 4a – Shallow Well

LEGEND



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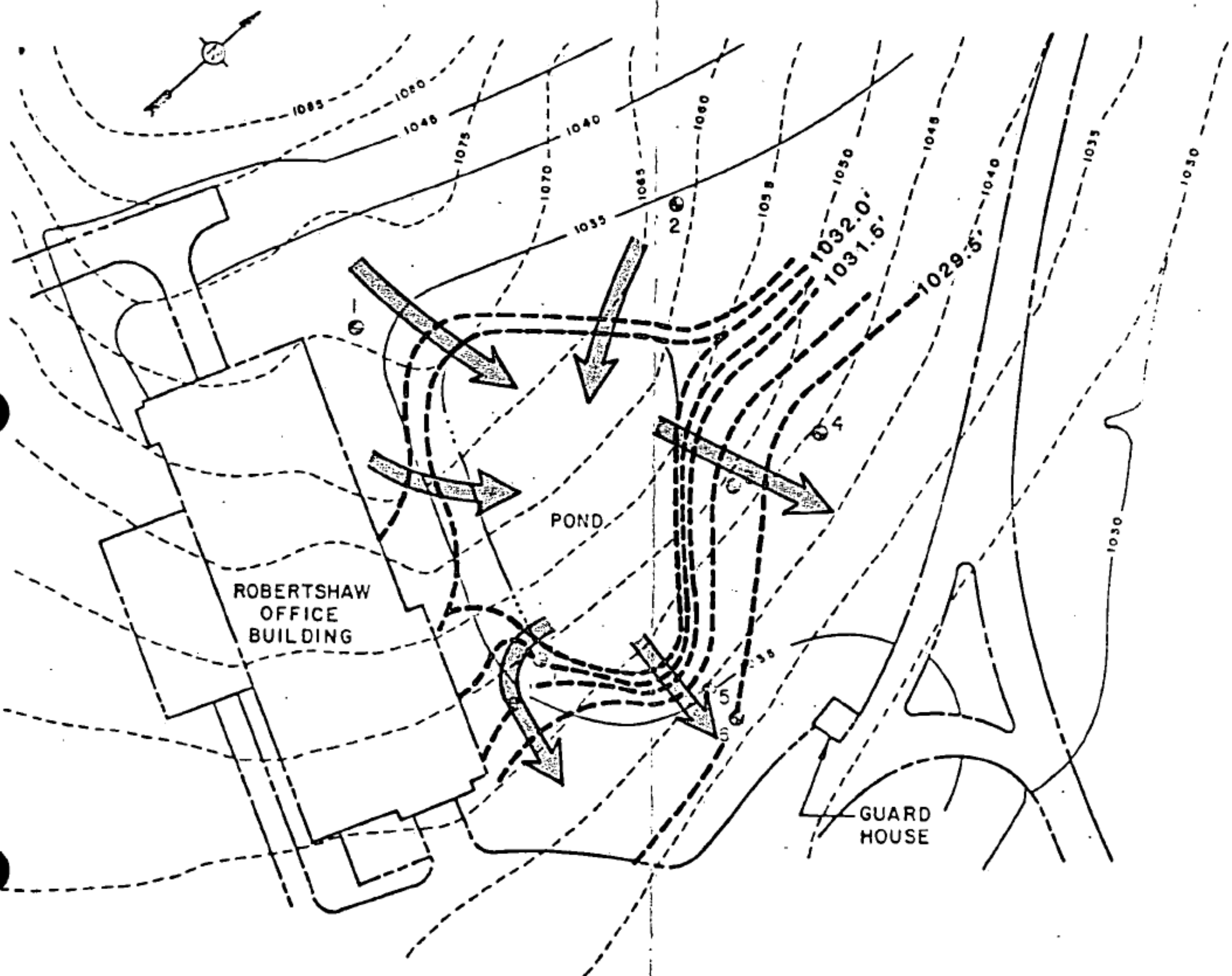

Figure 4d – Shallow Groundwater Flow Pattern Assuming Hydraulic Continuity with Pond

Figure 4c and 4d

GAI CONSULTANTS, INC. Engineers • Geologists • Planners Environmental Specialists 570 Beatty Rd. • Pittsburgh, Monroeville, Pa. 15146 412-242-6530	GENERALIZED GROUNDWATER FLOW DIRECTION	DWN. [redacted] CHKD.
		APPD. DATE
	ROBERTSHAW CONTROLS COMPANY NEW STANTON DIVISION NEW STANTON, PENNSYLVANIA	SCALE: 1" = 400'
		DRAWING NUMBER 79-204-B4 REV

PW 1265–1277

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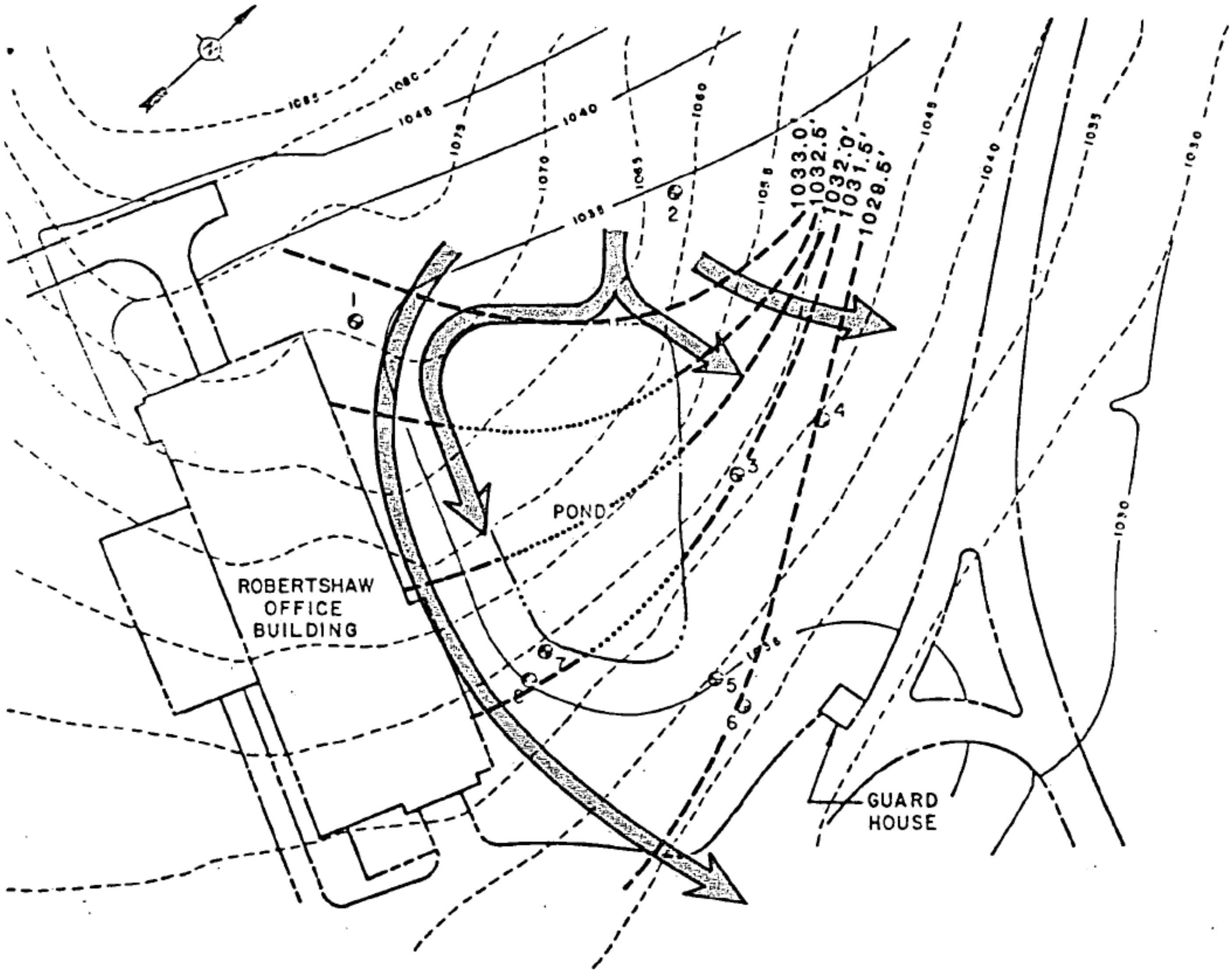

Figure 4c – Shallow Groundwater Flow Pattern Assuming No Hydraulic Continuity with Pond

ORIGINAL (Red)

CONSULTANTS, INC.

PROJECT ROBERTSHAW MONITORING WELL — PROJECT NO. 79-204

ELEVATION 1036.2' GWL 0 HRS 3.4' — BORING NO. 1

11/20/79 HRS 3.4'

DATE 11/16/79 FIELD ENGINEER not responsive based on revised scope [redacted] — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	WELL PACKING SEQUENCE CASING BLOWS	PROFILE	SOIL DENSITY-CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS::
1	2	3	4	5	6	7	8	9	10
1	2 5	O S-1			VERY LOOSE	BROWN	MOIST SANDY-SILT TOPSOIL/FILL	ML	15-20% SHALE FRAG.
2	12 16	O S-2			LOOSE	GRAY	SLIGHTLY MOIST HIGHLY WEATHERED		
3	11 13	O S-3			(FIRM IN-		SHALE W/ SOME INTERMIXED		CALCAREOUS
4	5 7				PLACE)		SOIL (FILL)		
5	50/.3			////					
6					MED. HARD	DARK GRAY	SILTY SHALE	BR	FRACTURED ALONG
7		5.5/5.6							HORIZONTAL BEDDING
8		14 min.							PLANES AND ALONG
9						DK. BLUISH GRAY	CLAY SHALE W/ SOME VERY THIN		ANGULAR FRACTURES
10							CALCAREOUS SEAMS		AT ≈ 60°. BOTH
11	10.4								SURFACES W/
12		5.3/5.4			MED. HARD			BR	Fe_2O_3 COATINGS.
13		13 min.							FRACTURES AT
14									11-12 FT & 13½-14½ FT
15			GRAVEL		~~SOFT~~	~~BLUISH GRAY~~	~~SLIGHTLY WEATHERED SHALE~~	~~V. BR~~	CONTAINED ZONE OF
16	15.5								WEATHERED SHALE
17									¼" TO ½" WIDE.
18		3.4/3.6	SHOT		MED. SOFT	GREENISH GRAY	CLAYSTONE W/ CLEAR LT. GRAY		FREQUENT (4"-6")
19							CALCAREOUS INCLUSIONS	BR	45° JOINTS W/
20	19.1								SLICKENSIDE
21		2.1/2.1							
22					CORING COMPLETED AT 21.2'				
					HOLE REAMED TO 6" TO DEPTH OF				WELL PUMPED
					20.5'. 1.7' OF STICK-UP FROM 4" DIA.				OUT AT 2:00 PM
					PVC. (TOTAL LENGTH 22.0 FT.)				ON 11/21/79

REMARKS:::: CONTINUOUS SPLIT SPOON SAMPLE TO 4.3' (REFUSAL), HOLE CLEANED W/ HOLLOW STEM AUGERS, 6" CASING SET TO 2'

PROJECT NO. 79-204

BORING NO. 1

:: POCKET PENETROMETER READINGS

:::: METHOD OF ADVANCING AND CLEANING BORING

ORIGINAL
(Red)

CONSULTANTS, INC.

PROJECT ROBERTSHAW MONITORING WELL | PROJECT NO. 79-204
ELEVATION 1036.4 GWL 0 HRS 0.8' | BORING NO. 2
15 HRS 1.4'
DATE 11/15/79 FIELD ENGINEER [redacted] | PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	WELL PACKING SEQUENCE / CASING BLOWS	PROFILE	SOIL DENSITY-CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	1	0 S-1			VERY LOOSE	BROWN	MOIST SANDY-SILT TOPSOIL/FILL	ML	20% WEATHERED SHALE FRAGMENTS
1	31								
	45	C S-2	BENTONITE		SOFT	GRAY	SLIGHTLY MOIST WEATHERED FISSILE SHALE	V.BR	BROKE EVERY ≈ 1/16"
2		0.9'/1.0'							ALONG BEDDING PLATES
3									
4					MED. SOFT	BLACK	SILTY SHALE W/ FEW VERY THIN	V.BR	
5		4.9'/5.0'					CALCAREOUS SILTSTONE		FRACTURED ALONG
6		18 MIN					SEAMS		HORIZONTAL BEDDING
7									AND AT ANGLE TO
8									BEDDING, SURFACES
9					MED. HARD	DARK GRAY		BR	SMOOTH, UNALTERED
10		4.9'/5.0'							THOUGH HAVING
11		15 MIN							CARBONATE REACTION
12									SHALE NON-REACTIVE
13									
14			GRAVEL		MED. HARD	DARK GRAY		BR	
		5.0'/5.0'							
16		15 MIN							
17			SHOT						
18									INCREASE IN
19		3.3'/3.3'			MED. HARD	BLACK-DK. GRAY	CLAY SHALE W/ SOME VERY THIN	BR.	NUMBER OF CAL-
20		4 MIN.					CALCAREOUS SEAMS		CAREOUS SEAMS &
21									BEDDING PLANE FRACTURES
22					CORING COMPLETED AT 20.8 FT.				WELL PUMPED-
					HOLE REAMED TO 6" DIA. TO DEPTH OF				OUT AFTER
					20.4 FT..				INSTALLATION
					4" DIA. PVC STICK-UP 1.8 FT. (TOTAL				11/21/79
					LENGTH 22.0 FT)				

REMARKS**** CONTINUOUS SPLIT SPOON SAMPLE TO 1.5' (REFUSAL), HOLE CLEANED W/ HOLLOW STEM AUGER, 6" CASING SET TO 2.0'

PROJECT NO. 79-204
BORING NO. 2

* POCKET PENETROMETER READINGS
**** METHOD OF ADVANCING AND CLEANING BORING

ORIGINAL (Red)

CONSULTANTS, INC.

PROJECT ROBERTSHAW MONITORING WELL

PROJECT NO. 79-204

ELEVATION 1032.4 GWL 0 HRS @ SURFACE

BORING NO. 3

HRS

DATE 11/20/79 FIELD ENGINEER not responsive based on revised scope [redacted]

PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	WELL PASSING SEQUENCE CASING BLOWS	PROFILE	SOIL DENSITY-CONSISTENCY OR ROCK HARDNESS (DESCRIPTION)	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS::
1	2	3	4	5	6	7	8	9	10
	3	0 S-1	BENTONITE		VERY LOOSE	BROWN	MOIST SANDY-SILT TOPSOIL/FILL	ML	30% SHALE FRAGMENTS
1	24								
2	50/4	0 S-2			DENSE	GRAY	SLIGHTLY MOIST WEATHERED FISSILE SHALE	V.BR	BROKE ALONG VERY THIN PLATES
3									
4							SHALE CUTTINGS		
5									
6			SHOT GRAVEL						
7									
8									
9					NO ROCK CORE SAMPLE TAKEN.				WELL PUMPED
10					HOLE REAMED TO 6" DIA. TO DEPTH OF				OUT @ 1:00PM
					7.8 FT.				11/21/79
					4" DIA PVC STICK-UP 0.8' (TOTAL				
					LENGTH 8.6 FT.)				

REMARKS:::: CONTINUOUS SPOON SAMPLE TO 1.4 FT. (REFUSAL), 6" CASING SET TO 1.5 FT.

PROJECT NO. 79-204

BORING NO. 3

:: POCKET PENETROMETER READINGS

:::: METHOD OF ADVANCING AND CLEANING BORING

ORIGINAL (Red)

CONSULTANTS, INC.

PROJECT ROBERTSHAW MONITORING WELL PROJECT NO. 79-204
ELEVATION 1033.2 GWL 0 HRS @ SURFACE BORING NO. 4
HRS not responsive based on revised scope
DATE 11/20/79 FIELD ENGINEER [redacted] PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	WELL CASING BLOWS	PROFILE	SOIL DENSITY-CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS::
1	2	3	4	5	6	7	8	9	10
	2	0 S-1			VERY LOOSE	BROWN	MOIST SANDY-SILT TOPSOIL/FILL	ML	5% WEATHERED C.F.
1	10								
	16	0 S-2			MED DENSE	YEL. BR TO GRAY	SLIGHTLY MOIST HIGHLY WEATHERED SHALE RESIDUUM		Fe_2O_3 STAINING ON
2	27								
	50/.4	0 S-3			DENSE				PLATE SURFACES
3			BENTONITE	////					
4					MED. SOFT	DARK GRAY	SILTY SHALE W/ FEW VERY THIN	BR	
5		4.4'/5.0'					CALCAREOUS SEAMS		FRACTURED ALONG
6									HORIZONTAL BEDDING
7									PLANES AND AT
8									ANGLE (45°-60°)
9					MED. HARD	DARK GRAY		BR	TO BEDDING.
10		5.0'/5.0'							SURFACES SMOOTH
11		22 MIN							W/ Fe_2O_3 COATING.
12									
13									
14			GRAVEL		MED. HARD	DARK GRAY		BR	
		5.0'/5.0'							
16		20 MIN							
17									
18			SHOT				CLAY SHALE W/ SOME VERY THIN		
19		3.3'/3.3'			MED. HARD	DK. GR. GRAY	CALCAREOUS SEAMS	BR	
20		15 MIN							
21									
22							CORING COMPLETED AT 21.0 FT. HOLE REAMED TO 6" DIA. TO DEPTH OF 21.0 FT. 4" DIA PVC STICK-UP 1.3 FT (TOTAL LENGTH 22.0 FT.)		WELL PUMPED OUT AFTER INSTALLATION 11/21/79

REMARKS:::: CONTINUOUS SPLIT SPOON SAMPLE TO 2.4 FT (REFUSAL), HOLE CLEANED w/ HOLLOW STEM AUGER, 6" CASING SET TO 2.1 FT. PROJECT NO. 79-204

BORING NO. 4

:: POCKET PENETROMETER READINGS

:::: METHOD OF ADVANCING AND CLEANING BORING

ORIGINAL
(Red)

CONSULTANTS, INC.

PROJECT ROBERTSHAW MONITORING WELL — PROJECT NO. 79-204
ELEVATION 1035.3' GWL 0 HRS @ SURFACE — BORING NO. 5
HRS
DATE 11/20/79 FIELD ENGINEER [redacted] — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	~~DRIVING SPOON~~ CASING BLOWS / WELL RATE	DESCRIPTION: PROFILE	SOIL DENSITY-CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS::
1	2	3	4	5	6	7	8	9	10
1	2 / 5	O S-1	BENT		VERY LOOSE	BROWN	MOIST SANDY-SILT TOPSOIL/FILL	ML	15% SHALE FRAGMENTS
2	12 / 16	O S-2			MED. DENSE	REDDISH BROWN	SLIGHTLY MOIST HIGHLY WEATHERED SANDY-SILT SHALE RESIDIUM	ML	
3	32 / 35	O S-3							PLATE SURFACES W/
4	35 / 46	O S-4			DENSE		DRY WEATHERED FISSILE SHALE		Fe_2O_3 STAINING
5			SILT GRAVEL						
6							SHALE CUTTINGS		
7									
8									
9					NO ROCK CORE SAMPLE TAKEN.				WELL PUMPED
10					HOLE REAMED TO 6" DIA. TO DEPTH OF				OUT AFTER
					7.5 FT.				INSTALLATION
					4" DIA. PVC W/ WELL SCREEN 8.6 FT LONG				11/21/79
					W/ 1.1 FT. STICK-UP				

REMARKS:::: CONTINUOUS SPLIT SPOON SAMPLE TO 4.0 FT (REFUSAL), 6" CASING SET TO 1.5 FT.

PROJECT NO. 79-204
BORING NO. 5

:: POCKET PENETROMETER READINGS
:::: METHOD OF ADVANCING AND CLEANING BORING

ORIGINAL (Red)

CONSULTANTS, INC.

PROJECT ROBERTSHAW MONITORING WELL PROJECT NO. 79-204

ELEVATION 1035.4 GWL 0 HRS 2.6' BORING NO. 6

24 HRS 5.5'

DATE 11/19/79 FIELD ENGINEER [redacted] PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	WELL PACKING / CASING BLOWS	DESCRIPTION: PROFILE	SOIL DENSITY-CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
1	2 / 7	0 S-1			VERY LOOSE	BROWN	MOIST CLAYEY-SILT TOPSOIL/FILL	MH	HIGH ORGANIC CONTENT
2	9 / 7	0 S-2	BENTONITE		LOOSE	YEL. BROWN	MOIST HIGHLY MOTTLED SILTY-SAND WEATHERED RESIDUUM	ML	20-30% DECOMPOSED SHALE FRAGMENTS
3	11 / 24	0 S-3			MED. DENSE		DRY DISTINCTLY MOTTLED PLATTY	ML	IRON STAINING
4	30 / 40				DENSE	LT. BROWN	WEATHERED SILTY SHALE RESIDUUM	V. BR	BETWEEN PLATES
5	50/.4	0 S-4		////					
6					MED. SOFT	DK. GRAY GRAY	SLIGHTLY WEATHERED, HIGHLY	V. BR	SUBANGULAR
7		3.0/4.0'					FRACTURED SILTY-SHALE		GRAVEL SIZE
8		20 min							FRAGMENTS w/
9									IRON STAINED
10									SURFACES
11		4.1/5.0'							
12		23 min							
13					MED. SOFT	D. G. BL GRAY	CLAY SHALE w/ VERY THIN	BR	FRACTURED ALONG
14			GRAVEL				CALCAREOUS SEAMS		BEDDING PLANES,
									NO IRON STAINING
16		4.5/5.0'							
17		27 MIN	SILT						
18									
19					MED. HARD			BR	
20		1.7/2.0'							FRACTURES w/
21		13 min			MED. SOFT	DK. GR. GRAY	LIMY CLAYSTONE	BR	SLICKENSIDE
22							CORING COMPLETED AT 21.0 FT.		WELL PUMPED-
							HOLE REAMED TO 6" DIA. TO DEPTH		OUT AFTER
							OF 21.3 FT		INSTALLATION
							4" DIA PVC STICK-UP 0.7 FT (TOTAL		11/21/79
							LENGTH 22 FT.		

REMARKS:::: CONTINUOUS SPLIT SPOON SAMPLE TO 4.4' (REFUSAL), HOLE CLEANED w/ HOLLOW STEM AUGER, 6" CASING SET TO 2.0' PROJECT NO. 79-204

BORING NO. 6

:: POCKET PENETROMETER READINGS

:::: METHOD OF ADVANCING AND CLEANING BORING

ORIGINAL
(Red)

CONSULTANTS, INC.

PROJECT ROBERTSHAW MONITORING WELL — PROJECT NO. 79-204
ELEVATION 1034.4 GWL 0 HRS @ SURFACE — BORING NO. 7
HRS
DATE 11/20/79 FIELD ENGINEER [redacted] — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	CASING BLOWS	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY-CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS::
1	2	3	4	5	6	7	8	9	10
1	7 25	0 S-1			LOOSE	DK BROWN	MOIST SANDY-SILT TOPSOIL/FILL	ML	25% INTERMIXED
2	35 23	0 S-2			MED. DENSE	BROWN	SLIGHTLY MOIST SANDY-SILT FILL	ML	SHALE FRAGMENTS
3	35 50/.2'	0 S-3		////	DENSE	GRAY	DRY SLIGHTLY WEATHERED FISSILE SHALE	V.BR	
4									
5							SHALE CUTTINGS		
6									
7									
8									
9					NO CORE SAMPLE TAKEN.				WELL PUMPED -
10					HOLE REAMED TO 6" DIA. TO DEPTH				OUT AFTER
					OF 7.4FT.				INSTALLATION
					4" DIA. PVC STICK-UP 1.2' (TOTAL				11/21/79
					LENGTH 8.6 FT.)				

REMARKS:::: CONTINUOUS SPLIT SPOON SAMPLE TO 2.7 FT. (REFUSAL), 6" DIA CASING SET TO 2.0 FT.

PROJECT NO. 79-204
BORING NO. 7

:: POCKET PENETROMETER READINGS
:::: METHOD OF ADVANCING AND CLEANING BORING

ORIGINAL (Red)

CONSULTANTS, INC.

PROJECT ROBERTSHAW MONITORING WELL — PROJECT NO. 79-204

ELEVATION 1036.6' GWL 0 HRS 4.1 FT. — BORING NO. 8

20 HRS 5.0 FT.

DATE 11/17/79 FIELD ENGINEER [redacted] — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	WELL PACKING SEQUENCE / CASING BLOWS	PROFILE	SOIL DENSITY-CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS::
1	2	3	4	5	6	7	8	9	10
1	2 / 2	0 S-1			VERY LOOSE	DK BROWN	MOIST CLAYEY-SILT TOPSOIL/FILL	MH	10-15% C.F.
2	31	0 S-2	BENTONITE	////	DENSE	GRAY	WEATHERED FISSILE SHALE	V.BR.	SPLIT TO NUMEROUS PLATES.
3					MED. SOFT	BLACK DK GRAY	SILTY SHALE	BR.	
4		5.0'/5.0'							FRACTURED ALONG
5		18 min							HORIZONTAL BED-DING PLANES
6					MED. HARD				AND AT 45°-60°
7									TO BEDDING.
8									FRESH UNALTERED
9		5.0'/5.0'			MED. HARD			BR.	SMOOTH FRACTURES
10		18 min							
11									
12									
13			SHOT GRAVEL		MED. HARD	DK. BL GRAY	CLAY SHALE W/ VERY THIN	BR.	
14		4.7'/4.7'					CALCAREOUS SEAMS		
15		16 min							
16									
17									FRACTURED EVERY
18		4.8'/4.8'			MED. SOFT	GR. GRAY	LIMY CLAYSTONE W/		4-6 IN. ALONG
19						W/ LT. GRAY INCLUSIONS	CALCAREOUS INCLUSIONS		SLICKENSIDE SURFA
20									AT ≈ 45° TO
21									BEDDING
22					CORING COMPLETED AT 21.0 FT.				WELL PUMPED-
					HOLE REAMED TO 6" DIA. TO DEPTH				OUT AFTER
					OF 21.0 FT.				INSTALLATION
					4" DIA. PVC STICK-UP 1.5 FT (TOTAL				11/21/79
					LENGTH 22 FT.)				

REMARKS:::: CONTINUOUS SPLIT SPOON SAMPLE TO 1.5 FT., HOLE CLEANED W/ HOLLOW STEM AUGER, 6" CASING SET TO 1.5 FT.

PROJECT NO. 79-204

BORING NO. 8

:: POCKET PENETROMETER READINGS

:::: METHOD OF ADVANCING AND CLEANING BORING

ORIGINAL (Red)

PENN ENVIRONMENTAL CONSULTANTS, INC.
FORT PITT PROFESSIONAL BUILDING
1517 WOODRUFF STREET
PITTSBURGH, PA. 15220
412-381-1133

GENERAL LABORATORY REPORT

A. CLIENT: GAI Consultants, Inc.	B. PEC PROJECT NO. 059-8792
C. SAMPLE SOURCE AND DATE: See below	
D. DATE ANALYZED 11-29-79	E. CHEMI[redacted]
F. TYPE OF SAMPLE	G. SAMPLE NO. See below

ANALYSIS		RESULTS
Sample	PEC #	Hg, ug/l
1	50417	<.5
2	50418	<.5
3	50419	<.5
4	50420	<.5
5	50421	<.5
6	50422	<.5
7	50423	<.5
8	50424	<.5

REMARKS: Project 79-204

ORIGINAL

PENN ENVIRONMENTAL CONSULTANTS, INC.
FORT PITT PROFESSIONAL BUILDING
1517 WOODRUFF STREET
PITTSBURGH, PA. 15220
412-331-1133

ORIGINAL
(Red)

GENERAL LABORATORY REPORT

A. CLIENT GAI Consultants, Inc.	B. PEC PROJECT NO. 059-3767
C. SAMPLE SOURCE AND DATE See below	
D. DATE ANALYZED 11-21-79 / E. CHEMIST [redacted] / F. TYPE OF SAMPLE	G. SAMPLE NO. See below

ANALYSIS		RESULTS
Sample	PEC #	Hg
S-1 Pond 11/19	50297	1.0 ug/l
S-2	50298	<.5 ug/l
S-3	50299	<.5 ug/l
S-4 11/20	50300	1.1 ug/l
S-5	50301	<.5 ug/l
S-6	50302	<.5 ug/l
S-7	50303	<.5 ug/l
S-8 Pond Bentonite	50304	2.2 mg/kg

REMARKS: [illegible]

PEC

PENN ENVIRONMENTAL CONSULTANTS, INC.
FORT PITT PROFESSIONAL BUILDING
1517 WOODRUFF STREET
PITTSBURGH, PA. 15220
412-381-1133

ORIGINAL
(Red)

GENERAL LABORATORY REPORT

A. CLIENT: GAI Consultants, Inc.	B. PEC PROJECT NO. 059-8830
C. SAMPLE SOURCE AND DATE: See below	
D. DATE ANALYZED: 12-10-79	E. CHEMIST: [redacted]
F. TYPE OF SAMPLE:	G. SAMPLE NO.: See below

ANALYSIS		RESULTS
Sample	PEC #	Hg, %
RX-1	50572	.0002
RX-2	50573	<.0001
RX-3	50574	.0003
RX-4	50575	.0003
RX-5	50576	.0003
RX-6	50577	<.0001
RX-7	50578	.0003
RX-8	50579	.0001
RX-9	50580	.0006
RX-10	50581	.0011
RX-11	50582	<.0001
RX-12	50583	.0012
RX-13	50584	.0011
RX-14	50585	<.0001
RX-15	50586	<.0001
RX-16	50587	<.0001

REMARKS:

Samples taken from discolored, polished, or weathered surfaces

Project 79-304

ORIGINAL